

Global Exploration Roadmap Science White Paper Overview

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May 15, 2015

Science White Paper – Concept & Scope



◆ Describe an international view of the science that could be enabled by missions in the GER

- Engage the scientific communities in identifying these opportunities
- Target the same stakeholder community as the GER – stakeholders, decision makers, broader human space exploration community while engaging the scientific community → concise formulation
- Distribute as a companion document to the GER with next update (2016)
- Focus on human missions and human/robotic concepts with emphasis on early mission themes, but incorporate the driving science priorities up to Mars

◆ Foster a deeper mutual understanding of priorities, challenges and opportunities for both scientific and exploration communities

◆ Incorporate interdisciplinary scientific themes that

- involve various communities, e.g. Planetary Science, Space Science, Life Sciences, Astrobiology, Astronomy, Physical Sciences, potentially including Strategic Knowledge Gaps
- Links to and translates substantive authoritative literature from the international science community

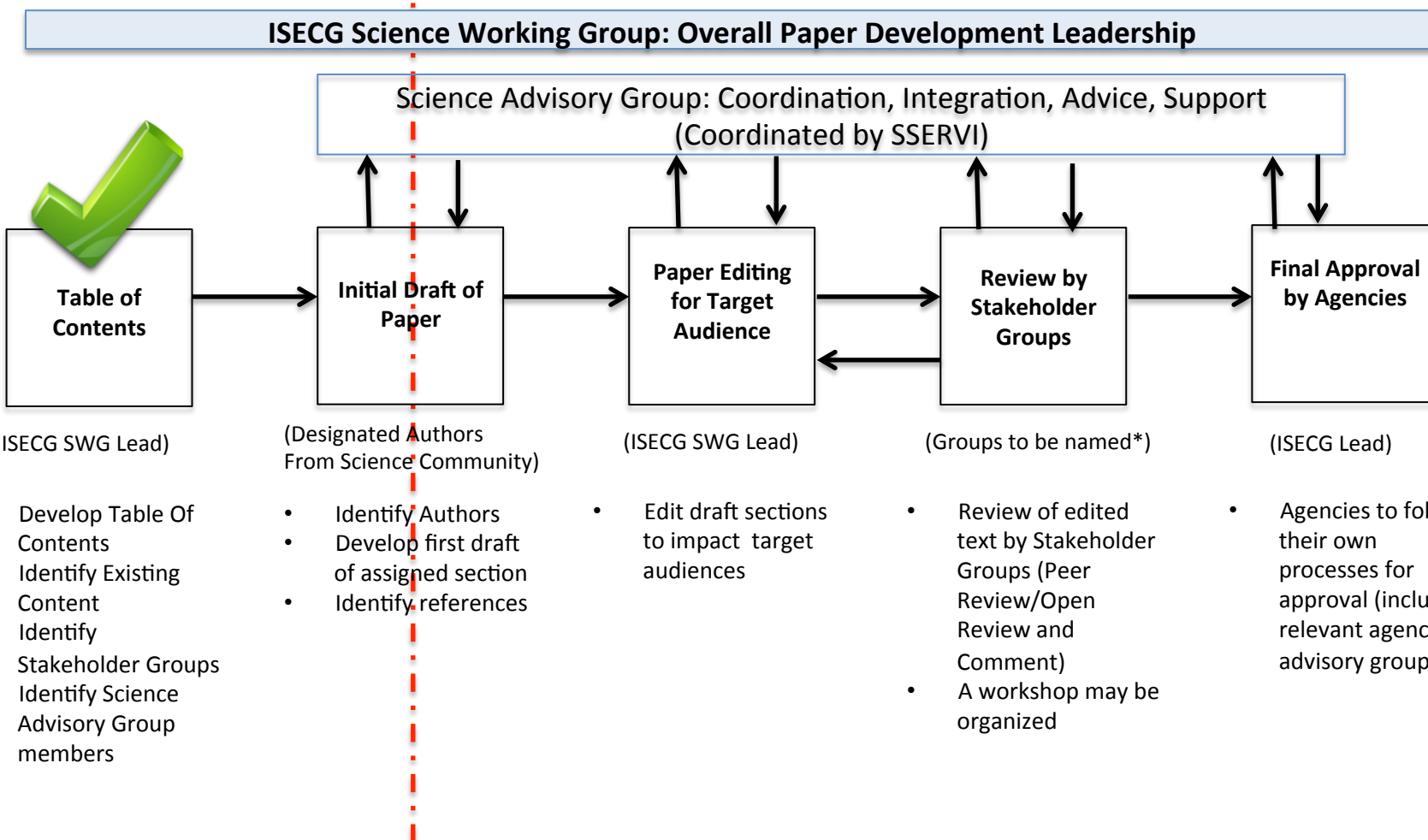
◆ Transparent, interactive process allows for two-way communication on science opportunities and feedback on GER missions

Paper Development Process



All dates
TBC

Oct 2014 → Feb 2015 → Summer 2015 → Jan 2016 → April 2016 → Summer 2016



* Groups expected to include LEAG, SBAG, MEPAG, COSPAR, IMEWG, IPEWG, ISLSWG, national science groups, others

SAG Membership



◆ Co-chairs:

1. Ben Bussey (NASA HEOMD Chief Scientist, USA) david.b.bussey@nasa.gov
2. Jean-Claude Worms (ESF, France) jcworms@esf.org

◆ Members

3. Gilles Clement (Univ. of Lyon, France) gilles.clement@inserm.fr
4. Ian Crawford (Univ. of London, UK) i.crawford@ucl.ac.uk
5. Mike Cruise (Univ. of Birmingham, UK) a.m.cruise@bham.ac.uk
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11. Masaki Shirakawa (JAXA, Japan) shirakawa.masaki@jaxa.jp
12. Tim McCoy (Smithsonian, USA) mccoyt@si.edu

◆ Executive Secretary

- Greg Schmidt (SSERVI lead, USA) gregory.schmidt@nasa.gov

KEY MESSAGE: THE SAG MEMBERSHIP IS STILL OPEN, ESPECIALLY TO ISECG AGENCIES AND COUNTRIES NOT YET REPRESENTED

SAG-SWP Support



- ◆ **Science Opportunities of a Cislunar Deep Space Habitat**
 - Co-Leads: Giles Clement & Gordon Osinski

- ◆ **Science Opportunities at a NEA in Cislunar space**
 - Co-Leads: Masaki Fujimoto & Tim McCoy

- ◆ **Science Opportunities on the Lunar Surface**
 - Co-Leads: Ian Crawford & Clive Neal

- ◆ **Other SAG members may choose to support one or more chapters.**

◆ Cislunar Deep Space Habitat

- Crew of four
- Initially annual missions lasting 30 days
- Increase both duration & frequency later in the decade.

◆ Near Earth Asteroid in Cislunar space

- Boulder collected using SEP-based s/c
- Crew of two visits asteroid boulder in lunar DRO

◆ Lunar Surface

- Five 28-day missions with a crew of four
- One mission per year
- Reuse pressurized rover for each mission
- Rover is moved to next landing site in between crewed visits

Table of Contents (as of 04/2015) – total ~20 pages

◆ Exec. Summary (2)

- Methodology / Process
 - Document is developed by ISECG agencies incorporating science community perspectives

◆ 1. Linkage to GER (2)

- GER approach
 - Connection to GER Goals & Objectives (?)
 - Long-term horizon goal (Mars)
 - Near-term destination focus
- Human-robotic partnership / Value of human presence

◆ 2. Science Topics (2)

- Capture the scientific interest of Moon/Asteroid research
- Science topics (overview)

◆ 3. Cis-Lunar Deep Space Habitat (4)

◆ 4. NEA in Cis-Lunar Space (4)

◆ 5. Lunar Surface (4)

- Each chapter 3-5 to highlight
 - Short summary of the mission theme including DRMs → SWG
 - Scientific opportunities in relation to the science topics → SAG
 - Science recommendations → SAG

◆ Conclusion (1)

◆ References (1)

- E.g. GER3, COSPAR PEX, Decadal Surveys, MEPAG report, ILEWG, others

◆ Living and working in space (= applied science ?)

- Overarching question(s):
 - How do we become a spacefaring species?
 - How do we sustain life in hostile environments? / Is life outside Earth sustainable? / Is human life confined to Earth?
- Disciplines involved, e.g.
 - Human physiology, life sciences and life support
 - Prospecting and utilising local resources

◆ Our Place in the universe (= fundamental science ?)

- Overarching question(s):
- Disciplines involved, e.g.
 - Astronomy
 - Planetary formation and evolution
 - Solar physics, space physics
- Co-evolution of life in the planetary environment ?
- Understanding the building blocks of life = astrobiology ?

Agenda – Frascati – 15 May 2015



- ◆ **9h00-9H20** **GER Summary**
 - Presenters/Moderators: Juergen Hill and Francois Spiero
- ◆ **9h20-10h00** **SWP Overview & Science Topics**
 - Presenters/Moderators: Ben Bussey and Jean-Claude Worms
- *10h00-10h15* *Coffee Break*
- ◆ **10h15-11h15** **Science Opport. of a Cis-lunar Deep Space Habitat**
 - Moderators: Ben Bussey and Jean-Claude Worms
- ◆ **11h15-12h15** **Science Opportunities at a NEA in cis-lunar space**
 - Moderators: Ben Bussey and Jean-Claude Worms
- *12h15-13h30* *Lunch*
- ◆ **13h30-14h30** **Science Opportunities on the Lunar Surface**
 - Moderators: Ian Crawford and Clive Neal
- ◆ **14h30** **Concluding Remarks**
 - Moderators: Ben Bussey and Jean-Claude Worms
- *14h45-15h 00* *Adjourn for Public Sessions / Coffee Break*
- ◆ **15h00-17h30** **SAG meeting**
 - Ben Bussey and Jean-Claude Worms

All sessions on science opportunities last 1 h and are structured like this:

- 10 minutes: general introduction by the moderators:
 - Describe GER Design Reference Missions
 - Show scientific references
- 45 minutes: general brainstorming
 - Collect ideas
 - Go to each of the science topics
- 5 minutes: small break